MULTIMEDIA UNIVERSITY

STUDENT ID NO

Table No.	

MULTIMEDIA UNIVERSITY

FINAL EXAMINATION

TRIMESTER 1, 2022/2023 (TERM ID 2210)

TSN1101 – COMPUTER ARCHITECTURE AND ORGANIZATION

(All sections / Groups)

08 FEBRUARY 2023
2:30 PM – 4:30 PM
(2 Hours)

INSTRUCTIONS TO STUDENTS

1. This Question paper consists of 10 pages including cover page with 4 Questions. Attempt **ALL** questions.

2. The total mark for this paper is 40 marks.

3. Write all your answers in this booklet.

QUESTION 1

a) Convert the decimal number 56.23 into the following number/code systems up to 3 accuracy point. Show all steps.

[4 marks]

i. Binary
ii. Gray Code
iii. Octal
iv. 8 4 -2 -1 Code

Continued...

b) A board game of 2 players needs 3 rounds to determine the final winner. Assume that Player 1 is denoted as 0, while Player 2 is denoted as 1. If Player 1 wins in Round 1, then it is indicated as 0, and vice versa, the same applies to Round 2 and Round 3. There is no draw in this game.

The player who scored majority will be the final winner. [2+2+2 marks]

i) Draw the truth table for the above problem indicating all possible combinations for the result of each round and the corresponding final winner.
ii) Minimize the expression into simplified Sum-of-Products (SOP) form.
iii) Construct a logic diagram using AND-OR gate network.

i) Truth Table

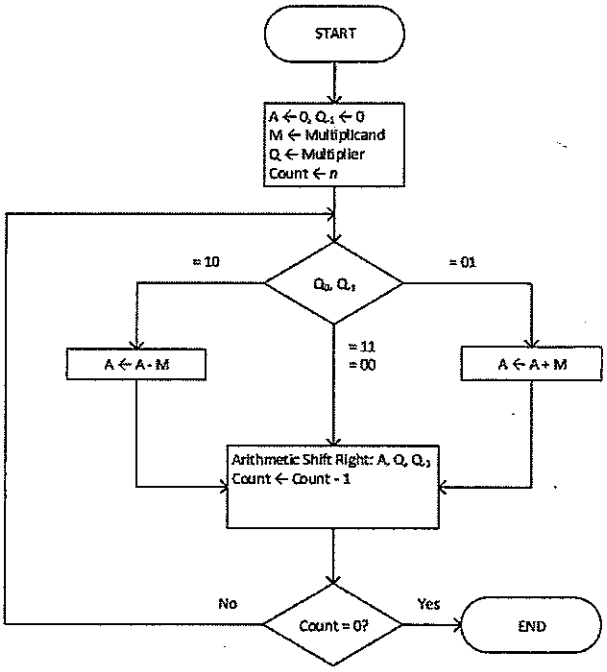
Round1	Round2	Round3	Final_Winner

Continued...

QUESTION 2

a) Perform the multiplication of two 4-bit two's complement binary numbers given below. Use BOOTH's algorithm as below. [4 marks]

Multiplicand (M) = 1100_2 (-4_{10})
Multiplier (Q) = 0010_2 (2_{10})



A	Q	Q_{-1}	M	Activity	Count
					Count = 4
					Count = 3
					Count = 2
					Count = 1
					Count = 0

Product =

Continued...

b) Assume that IEEE 754-32 bit single-precision format as given below is used for representing floating-point numbers. [4 Marks]

Sign	Biased exponent	Mantissa / Significand
1 bit	8 bits	23 bits

Given the decimal number -680.125, express it in 32 bits floating point format. Do the following steps.

i) Express the given number in binary format
ii) Give its normalized form based on step i
iii) Give the 8 bits biased exponent field
iv) Write the complete 32 bits floating point format

Continued...

c) Explain why the accuracy and precision are easier to maintain on digital systems as compared to analog systems. [2 Marks]

QUESTION 3

a) Suppose an 8-bit data stored in memory is 01011011. Using the Hamming algorithm, determine what check bits would be stored in memory with the data word. Show how you got your answer. [5 Marks]

Bit position												
Bits												
Word												
Check bit												

Continued...

b) Assume that a processor employs a memory address register (MAR), a memory buffer register (MBR), a program counter (PC), and an instruction register (IR), supporting only one-address instructions. List the symbolic sequence of micro-operations for the below instruction.

SUB R1, #0x1000

It denotes Subtract the data at #0x1000 from the data stored in Register 1 and store the result in R1. [3 Marks]

c) Pipeline hazards occurs when the pipeline or some portion of the pipeline needs to be stalled because conditions do not permit continued execution. There are a few types of data hazards. Explain the difference between (i) Read after Write data hazard, and (ii) Write after read data hazard. [2 Marks]

Continued...

QUESTION 4

a) Given the following registers and a two-address machine, give your program to compute $Z = (Y + P \times Q) / (Y - X)$. Available instructions are given below:

a. Registers: A, B and C
b. Instructions: MOV R1,#DATA
MOV R1, R2
ADD R1, R2
SUB R1,R2
MUL R1,R2
DIV R1,R2

Store the result in Register A. (Note: Instruction format – opcode destination, source)
[3 Marks]

Continued...

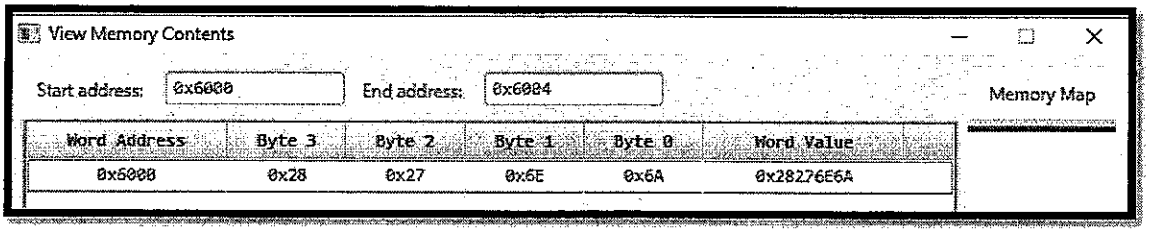
b) Name and describe the 4 types of I/O commands that an I/O module may receive from a processor.

[2 Marks]

Continued...

c) Write ARM instructions to store two 8-bit of data values $6A_{16}$, and $6E_{16}$ into memory addresses of 0x6000, and 0x6001 respectively. Perform the ADDITION arithmetic operation on both data. Store the 1's complement and 2's complement of the arithmetic's results into memory addresses 0x6002, and 0x6003 respectively. See below diagram on the expected output.

[5 marks]



End of Exam